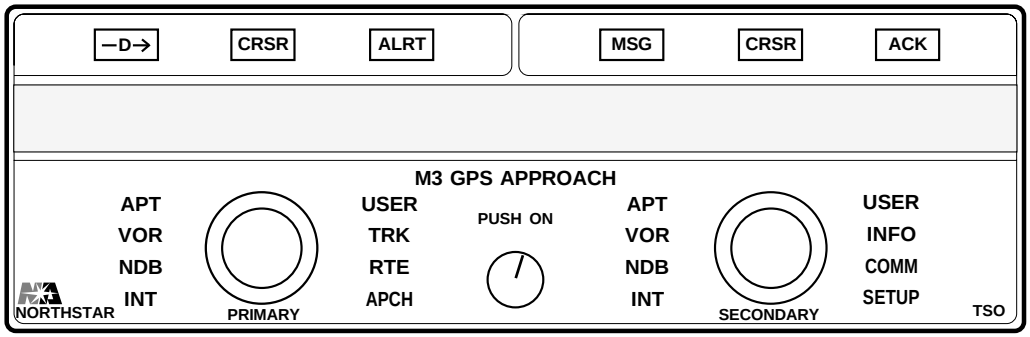
NORTHSTAR AVIONICS

M3 GPS *APPROACH*

P/N 1200-02-01
P/N 1200-03-01



Installation Manual

Revision D
March 25, 1998
Part No. GM611

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a division of CMC Electronics, Inc.

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Sales: 978/897-0770
Service: 978/897-7251
Fax: 978/897-7241

Revision history

Date	Pages	Revision
March 18, 1996	All	A (initial release)
July 1, 1996	All	B (update/rewrite)
May 1, 1997	1,26,31	C (add TSO approval)
	2, 5, 31	(add P/N 1200-03-01)
	23	(reducing interference)
	33,35,37	(STC and FMS amendment)
	49	(RSU-21 pin numbering)
March 25, 1998	cover, 29	D (area code change)
	2	(power requirement of 1200-03)
	2,21	(±120 mV To/From output)
	11	(AN120 dimensions)
	14	(Figure 7: P15 pin numbering)
	23	(ELT interference)
	30	(RMA # required for returns)

Ordering information

To receive additional copies of this publication, order the *Northstar Avionics M3 GPS Approach Installation Manual* (Part No. GM611).

Additional technical information is available on Northstar's web site:

http://www.northstarcmc.com

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SECTION ONE
Technical information

Scope of this manual

This manual describes the physical, mechanical, and electrical characteristics of the Northstar M3 GPS, included with the installation instructions. Operational information is found in the *Northstar M3 GPS Approach Reference Manual* (Part No. GM601), which is supplied with the unit.

Equipment description

The Northstar M3 GPS consists of a panel-mounted GPS receiver-navigator, mounting tray, and GPS antenna. The unit is approved under TSO-C129, Class A1. Use of the M3 is subject to airworthiness approvals limited to en route, terminal area, and non-precision approach operation under Visual Flight Rules (VFR) or Instrument Flight Rules (IFR). See Appendix B, STC Certificate SA00464NY (as ammended), for Federal Aviation Administration (FAA) Field Approval reference; and Appendix C, FAA-Approved Airplane Flight Manual Supplement (AFMS, formerly known as the Supplemental Air Flight Manual), for specific limitations and operating procedures under the STC.

The unit receives radio signals from GPS satellites and calculates its latitude and longitude from these signals. The unit's database is contained on a user-changeable FliteCard™. It provides the coordinates of thousands of airports, VOR and NDB transmitters, airway intersections, and routes and approaches. A variety of navigation functions may be performed using this data.

Interfacing the Northstar M3 to other equipment

The unit may be interfaced directly to many Course Deviation Indicators (CDIs), Horizontal Situation Indicators (HSIs), Flight Directors, and/or autopilots. Outputs also are provided to drive panel-mounted annunciators.

The unit also may be interfaced, through its built-in serial data port, to devices like fuel-management systems, moving map displays, or other devices designed to meet the Northstar serial data format described in the Northstar *Serial Data Format Specification V1.19 Firmware, Revision 2.2* (Part No. GM342). This document can be ordered by calling Northstar Avionics.

The M3 may be interfaced to an altitude encoder, either by connecting the individual encoder wires directly to the M3 or by using a Northstar 2006 Altitude Serializer. Altitude information enhances GPS accuracy and availability. Interfacing an encoder is recommended for all installations and is required for IFR-approved installations. Instructions for installing the serializer are in the specifications in the *Northstar 2006 Altitude Serializer Installation Manual* (Part No. GM435), which is included with the serializer.

> NOTE:
> *All installations require use of Northstar fans (Part No. 1090 for 14 volts or Part No. 1091 for 28 volts) or equivalent fans providing at least 2 CFM of cooling air. To ensure adequate air flow to unit, up to three feet of ScatTubing is acceptable.*

Technical specifications

Northstar M3 GPS navigator (Part No. 1200-02-01 or 1200-03-01)

Physical characteristics

Weight (with mounting tray) . . . . . 4.2 pounds

Dimensions:

- Height—2.0 inches
- Width—6.25 inches
- Depth (from rear of bezel to rear of tray)—11.75 inches

Cooling. . . . . Forced air cooling is required for all installations

Electrical requirements

Voltage . . . . . 10 to 35 VDC negative ground

Current . . . . . 1.5 A nominal at 14 VDC
0.85 A nominal at 28 VDC

Power . . . . . 35 watts nominal
(25 watts nominal for P/N 1200-02)

Interfaces to external equipment

CDI Loads . . . . . Up to five 1,000-Ohm loads

Full Scale . . . . . ±150 mV (maximum deviation output ±600 mV)

Valid Flag Loads . . . . . Up to three 1,000-Ohm loads
260 µA for flag out-of-view

Superflag . . . . . >18 VDC at 40 mA maximum

To/From Pointer. . . . . Up to three 200-Ohm loads, ±60 mV nominal to pull pointer
(±120 mV option available—contact factory)

Serial Data Channel . . . . . EIA RS-485 (compatible with EIA RS-422A)
EIA RS-422A

External Annunciator Drivers . . . . . 200 mA max. current; 30 VDC max. voltage (switched ground)

MESSAGE
RAIM
PARALLEL OFFSET
APPROACH
WAYPOINT ALERT
LOC ENERGIZE

Operational characteristics

DO-160C Env. Cat. F1CANBMXXXXXXZBABZUBXXX
Readouts. . . . . 32-character high-intensity alphanumeric LED
Switch Legends . . . . . Backlighted
Memory . . . . . Continuously powered by 10-year battery

GPS antenna (AN120)

Weight . . . . . 0.3 pounds
Dimensions . . . . . 4.30 inches × 2.70 inches
Height Above Skin. . . . . 0.70 inch
Depth Below Skin . . . . . 0.575 inch max plus TNC connector
DO-160C Env. Cat. . . . . A2F2-AC[CLMY]XRFX-SAX[AB][BZ]AVAL[1B]C
Manufacturer and Part No.. . . . . Comant Industries Antenna CI 405-7

GPS antenna (AN135)

Weight . . . . . 0.2 pounds
Dimensions . . . . . 3.44 inches × 2.20 inches
Height Above Skin. . . . . 0.61 inches
Depth Below Skin . . . . . 0.65 inch plus connector
DO-160C Env. Cat. . . . . F2AB(CLY)XSFDFSXXXXXXXXXC
Manufacturer and Part No.. . . . . Aero Antenna AT 575-9

GPS antenna (AN155)

Weight . . . . . 0.7 pounds
Dimensions . . . . . 4.70 inches × 2.90 inches
Height Above Skin. . . . . 0.75 inch
Depth Below Skin . . . . . 1.63 inches including connector
DO-160B Env. Cat. . . . . E1AB(JCYL)ASFDF-SZAAAAAAL2A
Manufacturer and Part No.. . . . . Canadian Marconi Company CMA-2052

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SECTION TWO
Installation instructions

General information

This section contains information for installing and wiring the Northstar M3 GPS, antenna, and interfaces.

All installation procedures should follow acceptable practices, methods, and techniques as described in Advisory Circulars (AC) 43.13-1A and 43.13-2A.

Special installation requirements

- Before inserting or removing the M3 from the mounting tray, turn off power to the tray using the avionics master switch or circuit breaker, even if the unit's power switch is turned off. This will prevent inrush current from arcing across the power connector.
- **Use only a GPS antenna specified within this manual.** Only the Northstar AN120, AN135, and AN155 antennas are approved for use with the M3. Consult the factory for special applications not covered in these instructions.
- The GPS antenna must be mounted on the top of the aircraft.
- The GPS antenna should be located at least two feet away from any other antennas and from the vertical stabilizer and canopy.
- Forced air cooling must be supplied to the unit for all installations.
- Electrical noise suppression of existing equipment may be required to obtain satisfactory performance.

Unpacking and inspection

The shipping carton contains the following components and parts:

- M3 GPS navigator (Part No. 1200-02-01 or 1200-03-01) and warranty card
- Mounting tray assembly
- GPS Antenna (AN120, AN135, or AN155)
- *M3 GPS Approach Reference Manual* (GM601)
- *M3 GPS Approach Pilot's Guide* (GM606)
- *M3 GPS Approach Installation Manual* (GM611)
- Parts kit bag containing:

  1 ea. air intake seal (HM502)
  1 ea. coax connector socket (KC225)
  1 ea. coax connector plug (KC310)

4 ea. 3-48 × G-inch screws (HS106)
2 ea. 4-40 × G-inch screws (HS201)
2 ea. 4-40 × K-inch screws (HS213)
4 ea. #3 lockwashers (HW090)
4 ea. #4 lockwashers (HW100)
2 ea. #4 flat washers (HW115)
1 ea. 24-pin connector (KC230)
1 ea. 36-pin connector (KC270)
1 ea. cable cover (XC495)
2 ea. connector float washers (XC435)
4 ea. mylar shims (HM750)

Make sure all parts are present and have sustained no shipping damage. If there is evidence of shipping damage, save the shipping carton and packing material to help substantiate your claim to the shipping company. Keep a shipping carton on hand in case you have to return the unit to the factory for service.

Preparing the antenna cables

Choosing the antenna coax

To connect the antenna to the GPS sensor, use RG-58 C/U coaxial cable (Alpha No. 9058C or equivalent). The outside diameter of the cable must be approximately 0.24 inches to be compatible with the supplied connectors. For a typical RG-58 cable loss of 23 dB per 100 feet at 1500 MHz, the cable length between the antenna and sensor should be at least 10 feet and not more than 50 feet. If the antenna cable is routed near sources of high electrical energy, then it is recommended that double-shielded coax be used to reduce radio-frequency interference. Shields should be grounded at both ends of the cable.

Type RG-59 coaxial cable is also acceptable. For typical RG-59 cable loss of 18 dB per 100 feet, the cable length should be at least 15 feet and not more than 80 feet.

Installing antenna cable connectors

TNC connectors are used at both ends of the antenna cable. The M3-end of the cable is assembled as shown in Figure 1, and attached to the rear of the M3 mounting tray.

Insert cable end into connector body. Start threads of nut by hand.

1. Hold the nut stationary, and turn the connector body over nut and cable assembly.
2. Check fit of center conductor and split pin; adjust if necessary, and solder.
3. Install cap.
4. Attach connector to rear panel of mounting tray as shown in Figure 7.

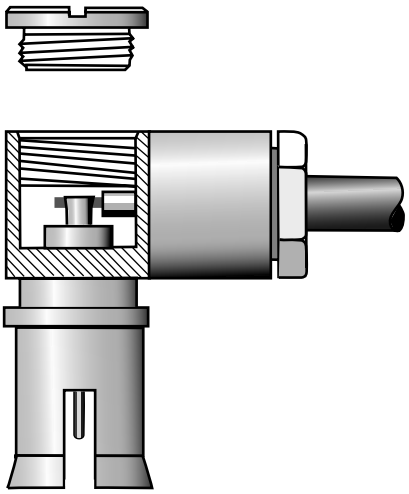


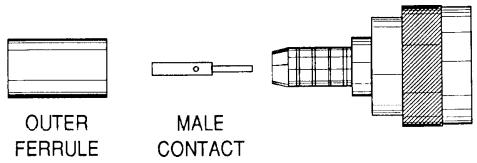
FIGURE 1 — Final Assembly of Rear Panel Coax Connector

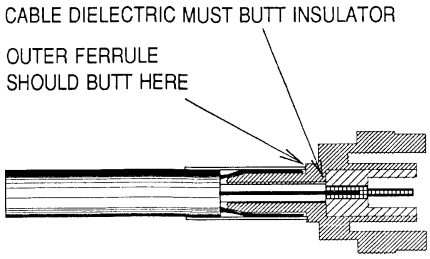
On the antenna-end of the cable, install the supplied straight TNC connector as shown below in Figure 2. If required for the particular installation, you may wish to substitute an optional right-angle TNC connector (Part No. KC290) or add a right-angle TNC adaptor.

Although the illustrations show assembly of the straight TNC connector, the following instructions apply to both the supplied straight TNC connector and the optional right-angle TNC connector. Use Amphenol crimp die number 227-1221-13 or exact equivalent. Stripping dimensions are A=0.34 inch (8.7 mm); B=0.09 inch (2.4 mm); C=0.15 inch (4.0 mm).

FIGURE 2 — TNC Connector Assembly

1. Strip cable jacket, braid, and dielectric to dimensions shown. All cuts must be sharp and square. Do not nick braid, dielectric, or center conductor. Tinning of center conductor is not necessary if contact will be crimped. For solder method, tin center conductor, avoiding excessive heat. Slide outer ferrule onto cable.
2. Flare end of cable braid to ease insertion onto inner ferrule. Do not comb out braid.
3. Place contact on cable center so it butts against cable dielectric. Center conductor should be visible through inspection hole in contact. Crimp or solder the contact in place as follows:
   - •Crimp method—use Cavity B of specified die set.
   - •Solder method—soft-solder the contact to cable center conductor. Do not get any solder on outside surfaces of contact. Avoid excessive heat to prevent swelling of dielectric.
4. Install cable assembly into body of assembly so that inner ferrule portion slides under braid. Push cable assembly forward until contact snaps into place in insulator. Slide outer ferrule over braid and up against connector body. Crimp outer ferrule using Cavity A of die set.





Installing the GPS antenna

NOTE:
If the Northstar AN155 GPS antenna is used, it is necessary to change a jumper wire inside the M3 unit to provide 12 volts to the antenna. Contact the Northstar factory for details.

Mount the GPS antenna on the top of the fuselage as shown below in Figure 3. Refer to Chapter Three of Advisory Circular 43.13-2A for practices, methods, and techniques. You must use an antenna that has been approved for use with the Northstar M3. The antenna must be securely grounded to the aircraft skin (remove any paint from the chosen location on the skin).

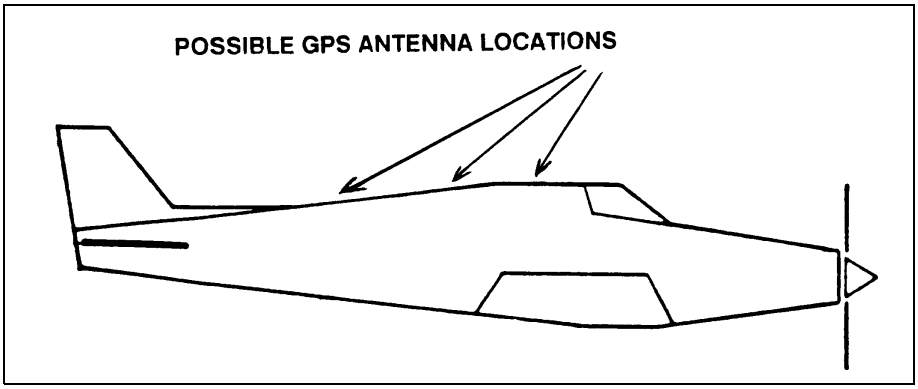


FIGURE 3 — Typical GPS Antenna Mounting Location

Adequate isolation must be provided between the GPS antenna and any transmitting antennas installed on the aircraft. Shadowing of the antenna by aircraft structure can adversely affect operation of the GPS equipment. Typically, a GPS antenna is located forward of the wings on the top of the fuselage to minimize effects of the wings, tail, etc. during aircraft maneuvering.

Ideally, the antenna should be located in the clear (at least two feet from any other antennas and at least three feet from transponder, DME, VHF, and UHF transmitting antennas) and where it isn't shadowed by the vertical stabilizer or the wings

.

NOTE:

The GPS signal is typically weaker than the background noise. Electrical noise near the antenna can adversely affect GPS performance. Antenna installation in close proximity to traffic alert and collision avoidance system (TCAS), satellite communication (SATCOM), and other transmitting antennas, particularly "L" band, should be carefully evaluated for potential mutual interference

For rotorcraft installations, the effects of the rotor blades on antenna performance must be considered. Depending on the structure and mechanical mounting considerations, the antenna may be located on the tail, in the vicinity of the anti-collision light. Visibility of the anti-collision light must not be impaired, however.

Approved GPS antennas

Three GPS antennas are currently approved for use with the Northstar M3. These are available as Northstar Part Numbers AN120 (Figure 4), AN135 (Figure 5), and AN155 (Figure 6).

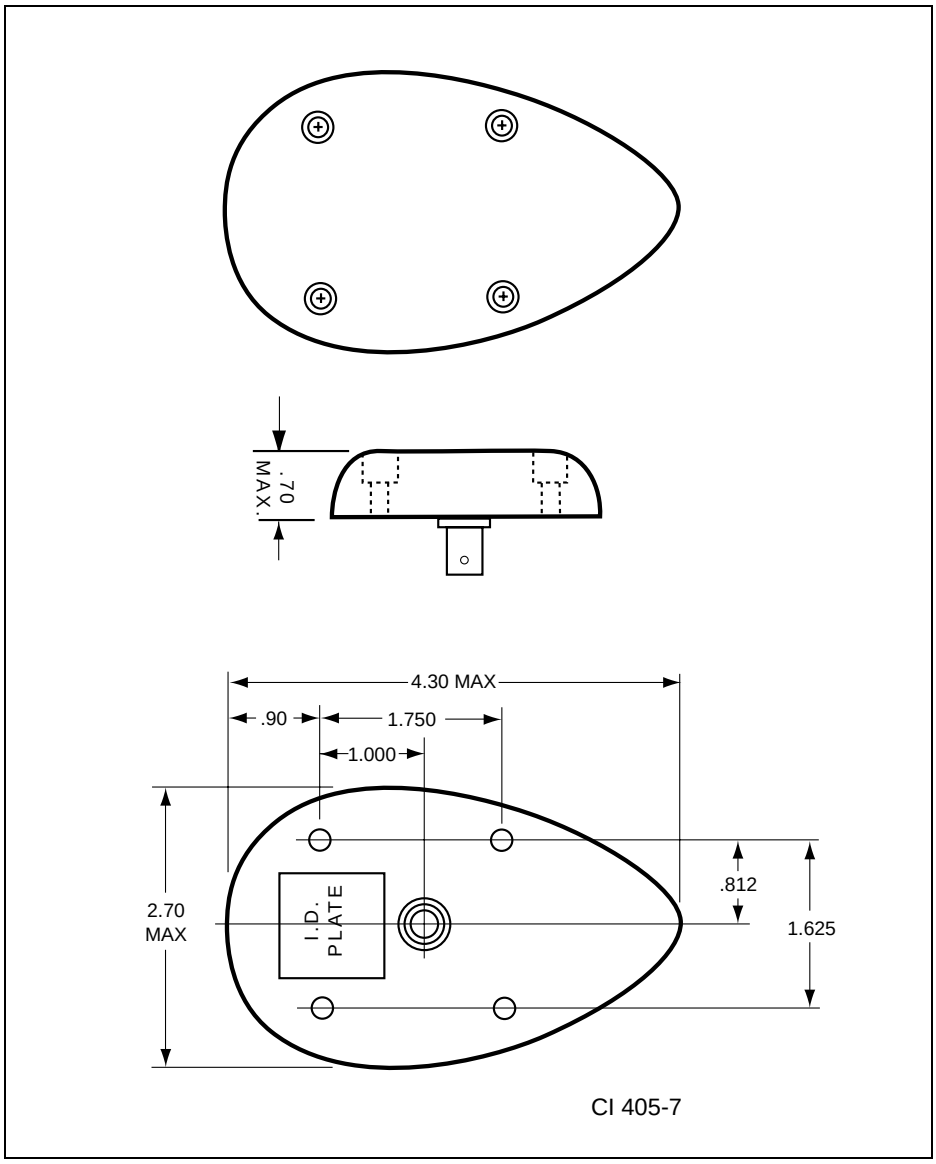


FIGURE 4 — AN120 Antenna Dimensions

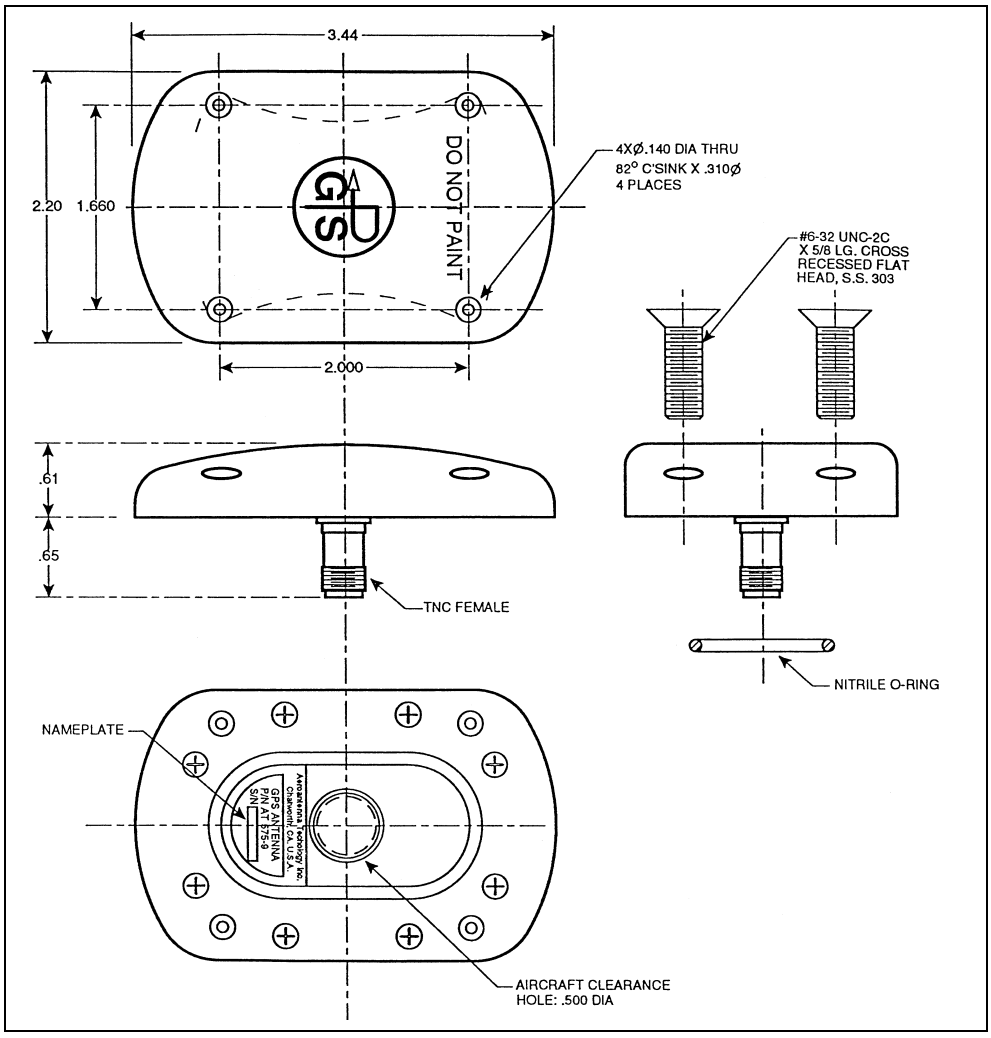


FIGURE 5 — AN135 Antenna Dimensions

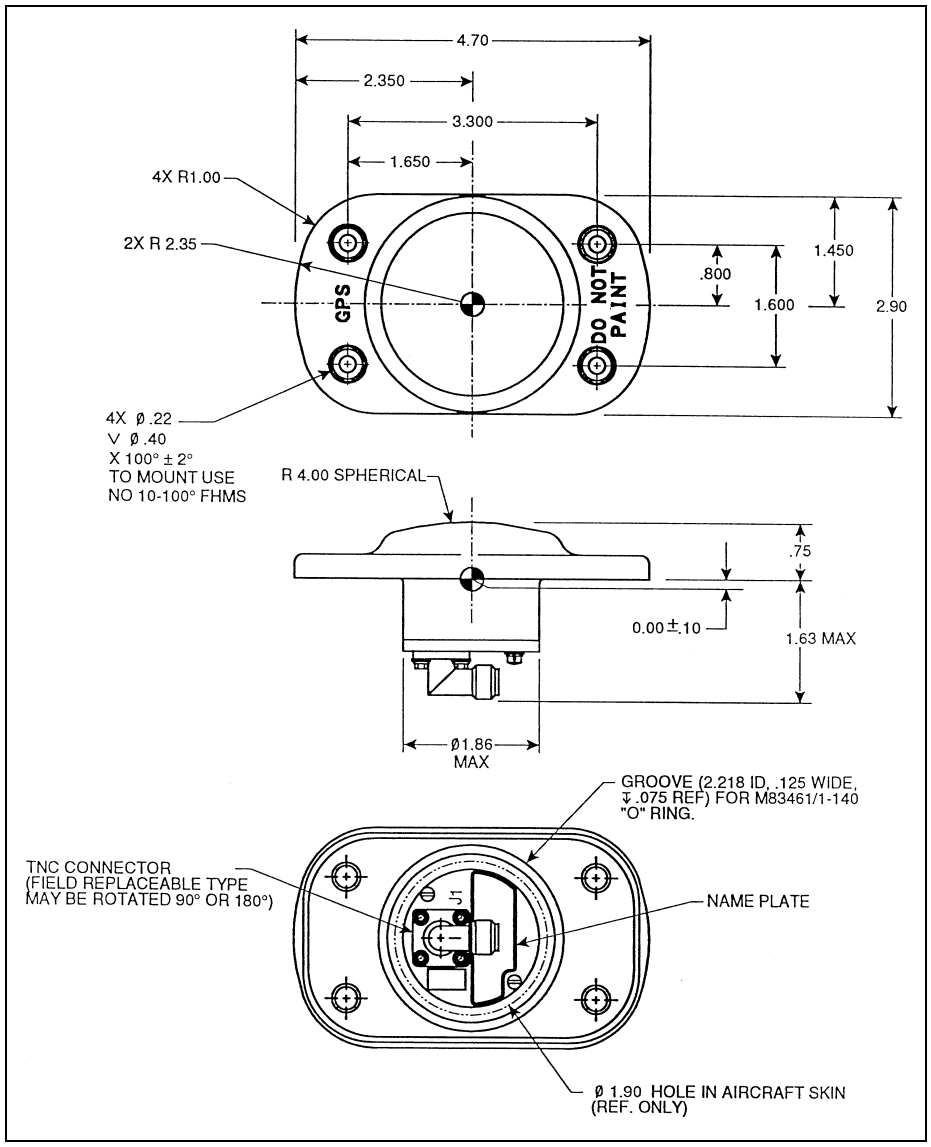


FIGURE 6 — AN155 Antenna Dimensions

Installing the M3 in the panel

The M3 is designed to be panel-mounted using the supplied mounting tray and hardware (see Figure 8). The M3 should be located so that the pilot and copilot have a clear view of, and access to, the unit. The preferred location is near the top of the center instrument stack.

To avoid nicks and scratches, leave the rubber band in place around the bezel until installation is complete. To facilitate pre-wiring of the connectors, the rear plate of the mounting tray (see Figure 7) may be removed with four screws located inside the tray.

The mounting tray is designed slightly oversized so the unit will slide in easily even if the tray is somewhat distorted during mounting. A set of self-adhesive mylar shims is provided to fill any space between the top or bottom of the unit and the mounting tray. One or more shims may be applied to the cover plates as necessary. Do not deform the cover plates by installing more shims than needed.

> ⚠ CAUTION ⚠
> *Before inserting the unit into the wired mounting tray, double-check all wiring. A small but significant number of units sustain damage because of incorrectly wired connections. Such damage is not covered under warranty. Improper voltage application may result in vaporized circuit-board conductors within the unit.*

Install the M3 in the panel as described below:

1. Make room for the unit in the instrument panel by relocating other equipment as necessary. Install the mounting tray in the panel. Wire the connectors mounted on the rear plate (see Figure 9). When finished, attach the rear plate to the mounting tray.
2. Supply clean, dry, forced cooling air to the air intake coupler. Cooling air is required for all installations.
3. Carefully slide the unit into the mounting tray. Unlike the Northstar M1, the M3 will stop approximately H inch from its final position. The retaining rod will draw the unit the remaining distance into the tray when it's tightened. Use a J-inch flat-blade screwdriver inserted through the hole in the front panel to tighten the rod. Do not overtighten!

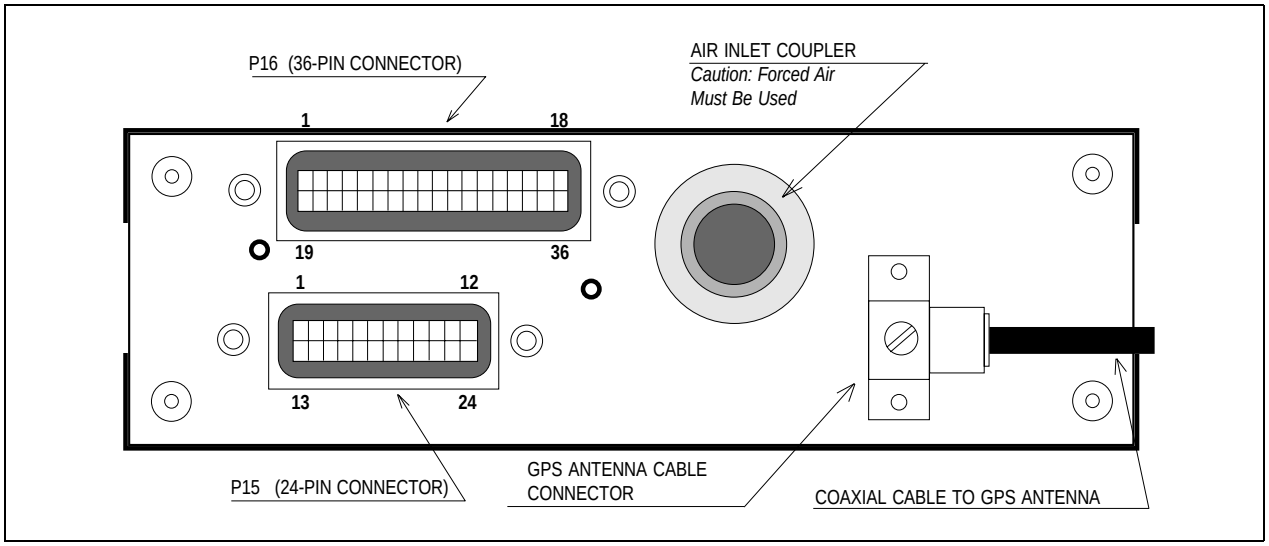


FIGURE 7 — Mounting Tray (rear view)

Table 1: 24-Pin Connector (P15)

Pin	Function	Pin	Function
1	Nav Flag +	13	10–35 VDC power input
2	CDI + Right deviation	14	10–35 VDC power input
3	CDI + Left deviation	15	N/C
4	Nav Flag –	16	Ground
5	Ground	17	Ground
6	RS-485 serial A out	18	N/C
7	N/C	19	N/C
8	N/C	20	**MESSAGE** annunciator out
9	Ground	21	**PARALLEL OFFSET** annunciator out
10	+5 volts out	22	Ground
11	RS-485 serial B out	23	Power Ground
12	**WAYPOINT ALERT** annunciator out	24	Power Ground

Table 2: 36-Pin Connector (P16)

Pin	Function	Pin	Function
1	RS-232 serial in (comm/trainer)	19	Altimeter input B1
2	RS-232 serial out (comm/trainer)	20	Altimeter input B2
3	To/From pointer (+ To)	21	Altimeter input B4
4	Superflag output (> +18 VDC = valid)	22	Reserved—do not use
5	Reserved—do not use	23	Reserved—do not use
6	Reserved—do not use	24	Altimeter input C4
7	RS-422 serial B out (future use)	25	Altimeter input C1
8	RS-422 serial A out (future use)	26	Altimeter input D4
9	RS-422 serial B in (altitude serializer)	27	Altitude encoder valid (> +5 VDC = valid)
10	RS-422 serial A in (altitude serializer)	28	Altimeter input C2
11	**APPROACH** annunc. out (formerly **VFR**)	29	**RAIM** annunciator out
12	Reserved—do not use	30	**APPROACH** annunciator out
13	Reserved—do not use	31	**LOC ENERGIZE** out
14	Reserved—do not use	32	**SPARE** annunciator out
15	Reserved—do not use	33	Reserved—do not use
16	Altimeter input A1	34	To/From pointer (+ From)
17	Altimeter input A2	35	Ground
18	Altimeter input A4	36	Ground

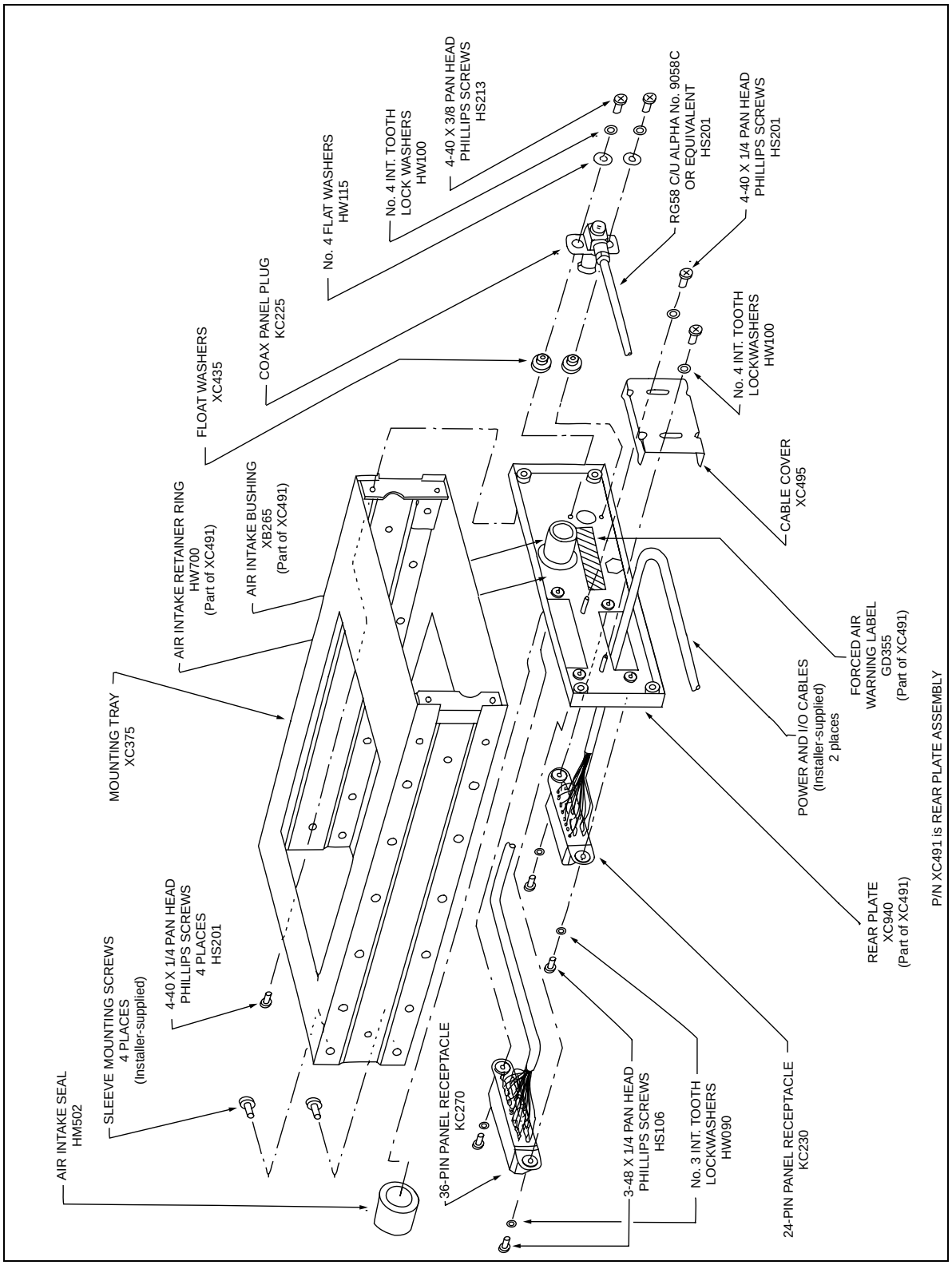


FIGURE 8 — M3 Mounting Tray (exploded view)

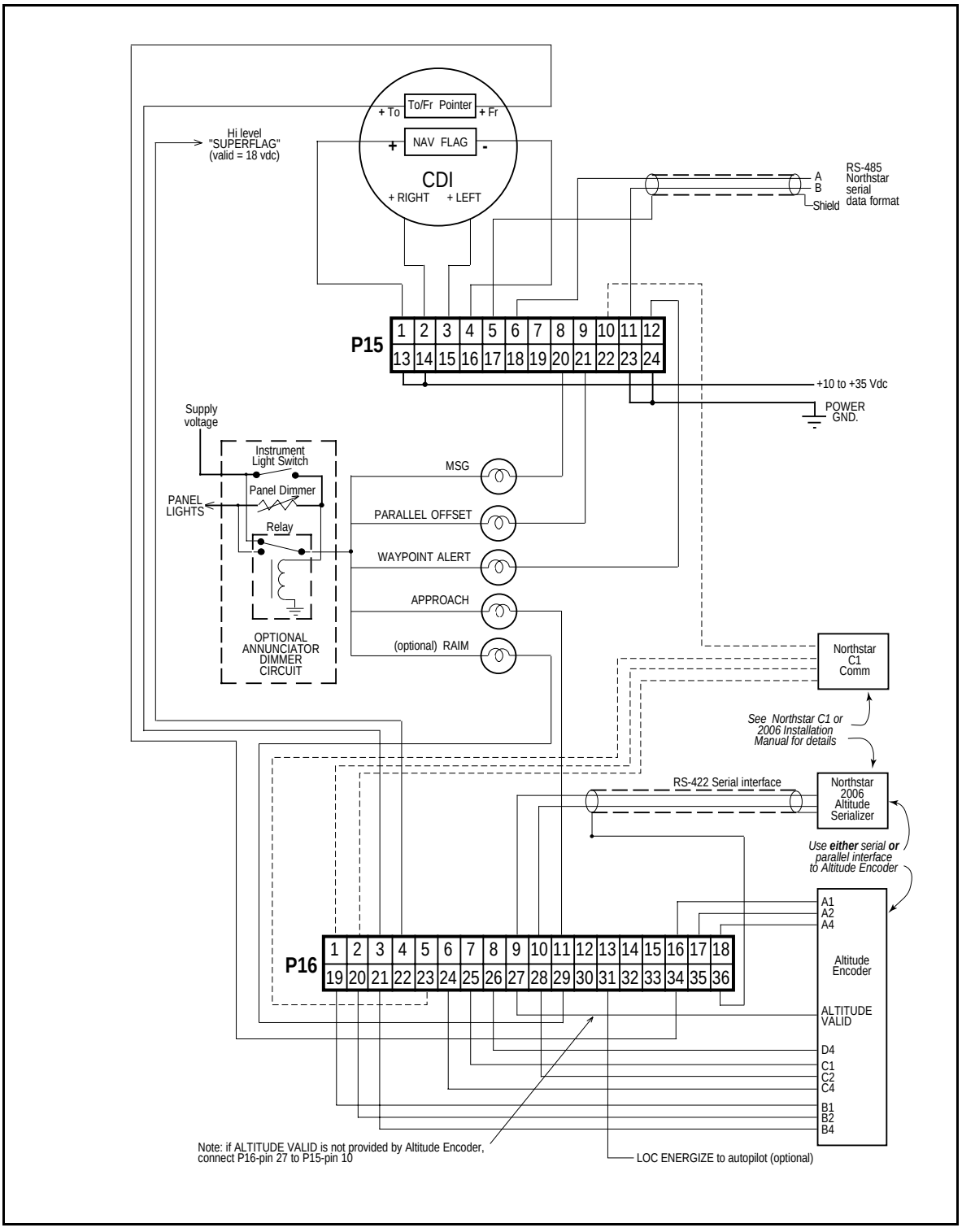


FIGURE 9 — M3 Wiring Diagram

Wiring the M3

Many of the external connections described below are optional for VFR installations, depending on the customer's desired configuration. If they won't be installed, leave the connector pins unconnected.

Power wiring

As shown in Figure 9, use P15, pins 13 and 14, to connect through a circuit breaker to 12 or 24 VDC. Connect P15, pins 23 and 24 to ground.

Annunciator wiring

Wire the remote panel-mounted annunciators as shown in Figure 9. Each annunciator output functions as a grounding switch, limited to a maximum of 30 VDC and 200 mA.

Each annunciator driver circuit is designed to power a single bulb at the rated current capacity. If two or more bulbs are connected to one output, the initial inrush current may activate over-current protection circuitry preventing bulb illumination. Install a 10-Ohm 1-Watt resistor in series to lower the inrush currect. Contact the factory for additional information.

Table 3: M3 Annunciators

Function	Conn./Pin	Abbreviation	Color
Message	P15 / 20	**MSG**	amber
Waypoint alert	P15 / 12	**WPT** or **WP ALRT**	amber
Parallel offset	P15 / 21	**OFFSET** or **PTK**	amber, white, or green
RAIM	P16 / 29	**RAIM**	amber
Approach	P16 / 11, 30	**APCH** or **APR**	blue or green
(Spare)	P16 / 32		

The **MESSAGE**, **WAYPOINT ALERT**, and **PARALLEL OFFSET** annunciators are required for en route IFR approval. The **APPROACH** annunciator is required for non-precision approach approval. It is recommended that the installer also wire the **SPARE** annunciator, bringing the leads to a convenient place behind the panel, and cap and stow them; these may be used in the future.

The **RAIM** annunciator is optional. In the event of a loss of RAIM capability or a RAIM-detected satellite failure, the **RAIM** annunciator will light and the **MESSAGE** annunciator will flash. Pressing **MESSAGE** on the M3 panel will display the appropriate RAIM-related message. The **RAIM** annunciator simply serves as an indication of what message the

MESSAGE button will show, and is not required, even for IFR installations.

The **APPROACH** annunciator signal is available on both pins 11 and 30 of P16, although these pins are electrically independent. The earliest en route-approved M3s required a **VFR** annunciator (connected to pin 11), and described pin 30 as a "future **APPROACH** annunciator." Later approvals removed this requirement for a **VFR** annunciator.

For new M3 installations, the **APPROACH** annunciator may be connected to either pin 11 or pin 30.

For en route-approved installations that are being upgraded to non-precision approach status, determine which configuration of annunciators had been previously installed from the following list:

- If neither **VFR** nor **APCH** is present, install a new blue or green annunciator labelled **APCH** and connect it to either pin 11 or pin 30 of P16.
- If **VFR** is not present, but **APCH** is present, no color change is required.
- If **VFR** is present, but **APCH** is not present, change the legend from **VFR** to **APCH**, and ensure that the color is either blue or green.
- If both **VFR** and **APCH** annunciators are present, the **VFR** annunciator must be disabled. Otherwise, both **VFR** and **APCH** would be illuminated when the M3 enters final approach mode.

The **APPROACH** annunciator is either blue or green.

CDI/HSI and autopilot wiring

For an IFR installation, an indicator showing cross-track deviation must be located in front of the pilot.

- **CDI/HSI** — Wire as shown in Figure 9, using an appropriate switching device between the M3 and the instrument to enable selective control by the pilot.

> NOTE:
> *The M3 will not drive a CDI with a built-in converter, such as the KI-208. Most others, however, having a 1,000-Ohm movement and requiring about 150 μA or 150 mV full scale, will work.*

- **Nav Flag** — Wire as shown in Figure 9. The M3 is designed to directly drive a flag with a 1,000-Ohm input impedance. It should be wired through the switching mechanism. A Nav Flag with a 300-Ohm movement may require a 2.7 K resistor installed in series

with the M3's output to reduce the current drive. A "superflag" output also is provided.

- **To/From Pointer** — Wire as shown in Figure 9, using the switching device as described above. *Note: A higher drive voltage (±120 mV) is available. Contact the factory for information.*
- **Localizer Energize Output** — This output is provided for connection to autopilots requiring a signal to enable flying a coupled approach. It is logically identical to the **APCH** annunciator output, but is electrically isolated from it. Like the annunciator outputs, this signal functions as a grounding switch, active low, and is limited to a maximum of 30 VDC and 200 mA.

Altitude encoder wiring

Interface to an encoding altimeter is required for IFR installations and is recommended for VFR use. The M3 has both a parallel and a serial interface available: either may be used. The serial interface requires the Northstar 2006 Altitude Serializer, which is already installed in many aircraft being upgraded from an M2 to an M3.

To use the parallel interface, connect the 11 wires as shown in Figure 9. If the altitude encoder does not provide an ALTITUDE VALID signal, see the note on Figure 9.

To use the serial interface, follow the directions in the *Northstar 2006 Altitude Serializer Installation Manual (*Part No. GM435).

Be sure to designate which interface is used with the appropriate **SETUP** command, described in *"Designating the altimeter data interface"* beginning on page 25.

Serial interface wiring

Two-conductor shielded twisted pair, such as Belden 9501 or MIL-C-27500, is recommended for interconnecting equipment connected to serial ports. The shield should be connected to chassis ground at both ends of the cable.

The M3's output data is binary coded, and includes latitude, longitude, signal status, SNR, ground speed, track angle, waypoint identification and location, cross-track error, magnetic variation, distance and bearing to waypoint, and flight plan information.

- **RS-485 Port for fuel management systems and/or moving map display** — This equipment must be configured to accept the Northstar data format. Be sure to specify this format when purchasing these units.
- **Northstar C1 Communications Transceiver** — To interface to the optional Northstar C1 Communications Transceiver, please refer to

the *Northstar C1 Installation Manual* (Part No. GM620) for more information.

The M3 doesn't require any setup or initialization to work with the equipment connected to serial ports. Detailed serial data specifications are available in the *Northstar Serial Data Format Specification, V1.19 Firmware, Revision 2.2* (Part No. GM342).

Initial checkout

Installing the M3

Before inserting the M3 into the mounting tray, turn off the master avionics switch or circuit breaker. Double-check all wiring for proper connections, especially power and ground.

> ⚠ CAUTION ⚠
> *Make sure you do not apply primary voltage directly to the left/right, to/from, and flag outputs of the unit; this action may vaporize circuit-board conductors within the unit. Damage to the unit from incorrectly wired connections is not covered under warranty.*

Carefully slide the unit into the mounting tray. ***Unlike the Northstar M1, the M3 will stop approximately H inch from its final position***. The mounting rod will draw the unit the remaining distance into the tray when it's tightened. Use a J-inch flat-blade screwdriver inserted through the hole in the front panel to tighten the rod. ***Do not overtighten*!**

Preliminary inspection and test

Move the aircraft outside and away from large buildings. Turn the avionics master switch on, and push the M3's **POWER** switch in to turn it on. A series of readouts shows the status of self-tests and the acquisition of GPS signals. The very first time the M3 is powered-up after installation, the unit will need to download a current almanac from the GPS satellites. This process takes about 20 minutes. If power is interrupted during this time, the process will repeat on the next power-up. After a successful almanac load, subsequent power-ups should take less than a minute. The following message is displayed when signal acquisition is complete:

```
NAVIGATOR READY / USE ANY SWITCH
```

Checking VHF interference

Harmonics of certain frequencies used for VHF transmissions can interfere with GPS signal reception. For installations that use GPS for primary IFR navigation, testing must be performed to verify adequate isolation

from this interference. Tests shall be conducted by tuning each VHF transmitter to the frequencies listed below and transmitting for 30 seconds, while observing the signal status of each or all satellites received. Degradation of individual satellite signals or all satellite signals to a point where navigation using GPS is no longer possible may not be acceptable for use under IFR, and requires that additional isolation or filter techniques are included in the aircraft installation or appropriate limitation stipulated in the Airplane Flight Manual Supplement (AFMS).

Table 4: Potential VHF Interferences

121.125 MHz	131.200 MHz
121.150 MHz	131.225 MHz
121.175 MHz	131.250 MHz
121.200 MHz	131.275 MHz
121.225 MHz	131.300 MHz
121.250 MHz	131.325 MHz
	131.350 MHz

The worst-offending equipment is often the VHF comm transmitter and associated antenna. Additional isolation may be obtained by increasing the separation between the VHF and GPS antennas or, in some cases, by re-routing antenna cables. Replacing the comm antenna with an inductive-fed type such as Comant CI-121 or Dorne Margolin DMC 70/11 may help. Low-pass filtering inserted within the VHF transmitter/receiver coaxial cable also may be used, provided that the VHF transmission and reception isn’t significantly degraded.

It has been noted that some ELT transmitters re-radiate harmonics of comm frequencies in the GPS band. Try disconnecting the ELT antenna if this is suspected. If the ELT is interfering, try relocating the ELT antenna or replacing the ELT with another type.

Configuring the M3

CDI centering and scale adjustment

The interface to an external CDI (or HSI) and annunciators must be calibrated for each installation. Be sure to complete the entire procedure—only the fifth step causes the changes to be stored in the unit's memory. This procedure also verifies correct wiring and operation of the CDI interface and annunciators.

NOTE:
If the unit has been designated as IFR-approved (by performing the procedure described in "Enabling IFR operation" beginning on page 25), this setting can be checked but not changed. If it's necessary to change this setting after the unit has been designated as IFR-approved, the unit first must be set back to VFR-only, and then returned to the IFR-enabled mode after the setting has been changed.

1. Turn the ***large secondary*** knob to **SETUP**.
2. Turn the ***small secondary*** knob to display:

CALIBRATE CDI,CK FLAGS,ANNCs.ACK?

3. Press **ACK**.
4. Rotate the ***small primary*** knob, if necessary, to precisely center the deviation bar. When properly centered, press **ACK**.
5. The CDI should indicate five increments to the left. If necessary, to achieve this, rotate the ***small primary*** knob, and then press **ACK**.
6. Check that the CDI indicates five increments right deflection. Rotate the ***small primary*** knob to scan through the entire deviation range to check its linearity and calibration accuracy. Compare the digital value displayed by the M3 with the CDI's reading. Turning this knob also will test the Nav Flag, To/From Pointer, and External Annunciators. Each knob click will activate one annunciator, as indicated on the readout. Note that not all the annunciators that can be tested are necessarily installed in your aircraft.

Setting the time zone

The M3 contains a battery-powered clock that enables it to constantly maintain the time and date, even when it's turned off. The battery has a design lifetime of 5 to 10 years. Time (according to **ZULU** time) and date are normally set at the factory during final inspection. The installer may leave the time zone set to **ZULU** or may set the time zone to local time, if desired. Designating the time zone will automatically adjust the displayed time to the correct offset from **ZULU** time.

The M3 automatically sets its internal clock to the date and time obtained from the GPS system as soon as the time is available, after power has been turned on, and the satellites have been acquired. This process occurs every time the M3 is powered up and re-acquires GPS satellites.

To set the time zone:

1. Turn the ***large secondary*** knob to **SETUP**.
2. Turn the ***small secondary*** knob to display the time of day and time zone:

   EASTERN STD TIME IS 10:24:32

3. Turn the ***small primary*** knob to select either Coordinated Universal Time (**ZULU**) or your local time zone as standard time (**STD**) or daylight savings time (**DST**).
4. Press **ACK**.

Designating the altimeter data interface

If the installation includes an interface to an altitude encoder, the installer must designate whether the serial or the parallel interface was used.

To designate the altimeter data interface as serial or parallel, perform the following steps:

1. Supply power to the M3 and push in the power switch to turn the unit on.
2. Turn the ***large secondary*** knob to **SETUP**.
3. Turn the ***small secondary*** knob all the way to the right to display:

   END OF FUNCTIONS

4. Simultaneously press both **CRSR** buttons to display:

   SVC.CODE -------

5. Press the right **CRSR** button, and use the ***small*** and ***large secondary*** knobs to enter the code **ALTSER** for serial interface or **ALTPAR** for parallel interface. When done, press the right **CRSR** button to turn the cursor off. The unit displays the confirmation message:

   OK, THANK YOU

Enabling IFR operation

If the installation has been approved for IFR use, the following procedure must be performed for the M3 to operate in IFR-enabled mode. In IFR-enabled mode, the altimeter data interface designation and the CDI

calibration procedure aren't accessible to the pilot, and each time the unit is turned on, it will display the message:

APPROVED FOR IFR

NOTE:
The installer is responsible for ensuring that this function is used appropriately. IFR-enabled mode is only allowed if all of the requirements have been met and IFR approval has been granted for the particular installation.

To set the M3 for operation in IFR-enabled mode, perform the following steps**:**

1. Supply power to the M3 and turn the power switch on.
2. Turn the ***large secondary*** knob to **SETUP**.
3. Turn the ***small secondary*** knob all the way to the right to display:

END OF FUNCTIONS

4. Simultaneously press both **CRSR** buttons to display:

SVC.CODE-------

5. Press the right **CRSR** button, and use the ***small*** and ***large secondary*** knobs to enter the code IFR. When done, press the right **CRSR** button to turn the cursor off. The unit displays the confirmation message:

OK, THANK YOU

   and will immediately switch to IFR-enabled mode.

To switch back to VFR-only mode, perform the above procedure, but enter VFR as the service code.

Limitations and approval procedures

The Northstar M3 GPS is designed to meet or exceed the Minimum Operational Performance Standards (MOPS) of RTCA/DO-208 and has received Technical Standard Order approval under TSO-C129, Class A1. TSO compliance alone is **not sufficient** to substantiate airworthiness

and acceptance of a Northstar M3 GPS installation. Installers seeking airworthiness and operational approval must consider the following:

- Approvals shall be based upon compliance with Federal Aviation Regulations (FAR) 21.33, 21.35, 23.1301, 23.1309, 23.1322, 23.1351, and 23.1431 appropriate for small airplanes or equivalent rules specific to make, model, and type, as well as other relevant FARs, Advisory Circulars, and FAA policy guidance.
- Advisory Circular 20-138, *Airworthiness Approval of Global Positioning System (GPS) Navigation Equipment for use as a VFR and IFR Supplemental Navigation System*, may be used as guidance for obtaining "follow-on" field approvals for using GPS navigation under VFR and IFR. Adherence to paragraphs 7.c.(2) for VFR or 8.c.(2) for IFR and Appendix 1 of this AC should be followed to ensure that every requirement is satisfied. Reference to the above paragraphs must be made in the application for Field Approval on an FAA Form 337. See Appendix D for sample FAA Form 337 language.
- For IFR-approved installations, an airplane flight manual supplement will be required to reflect the specific characteristics of the aircraft interface, if it's considered to be complex (for example, multiple navigation source switching between HSI or CDI to flight director and/or autopilot system). The flight manual supplement should contain any pertinent limitations, emergency and abnormal procedures, normal operating procedures, and performance changes. A copy of the FAA-approved *Airplane Flight Manual Supplement for STC SA00464NY* is in Appendix C.
- Advisory Circular 20-138 outlines the provisions that permit an FAA inspector to evaluate the installation, determine the adequacy of the descriptive data that was prepared for the alteration, and approve the flight manual supplement. Many FAA inspectors are qualified to perform this function, and will accept the responsibility; some FAA inspectors are not qualified. To determine qualifications, check with your local General Aviation or Flight Standards District Office.
- For VFR installations, a flight manual supplement probably won't be required unless complex characteristics like multi-navigation system switching are incorporated. A placard stating **GPS NOT APPROVED FOR IFR** must be positioned within immediate view by the flight crew.
- If approval has been obtained only for Class A2, a placard stating **GPS NOT APPROVED FOR APPROACHES** must be installed.

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SECTION THREE
Factory service policies

Limited warranty policy

Northstar Avionics, a division of CMC Electronics, Inc., warrants the M3 free from defects in materials and workmanship for a period of two (2) years from the date of shipment to an authorized dealer. This warranty applies to the original purchaser and/or subsequent owner.

This warranty covers repair and/or replacement, at our option, of any parts found to be defective, provided such defects, in our opinion, are due to faulty material or workmanship, and are not caused by tampering, abuse, or normal wear.

ALL WARRANTIES ARE F.O.B.
Northstar Avionics
30 Sudbury Road
Acton, Massachusetts 01720

Northstar will not accept or pay for any charges for warranty work performed outside of our plant.

This warranty applies only to products in normal use. It doesn't apply to units or circuit boards defective due to improper installation, physical damage, tampering, lightning or other electrical discharge, units with altered serial numbers, or units repaired by unauthorized persons or in violation of Northstar service procedures.

Northstar Avionics assumes no responsibility for any consequential losses of any nature with respect to any products or services sold, rendered, or delivered.

The foregoing are the only warranties expressed or implied. No other warranties exist.

Factory assistance by telephone

Please feel free to call our technical staff for assistance with service or installation at **978/897-7251** between 9:00 A.M. and 5:00 P.M. Eastern Time, Monday through Friday. **We do not accept collect calls.** Please have the serial number of the unit available when you call, along with as many details of the problem as possible, including SNR readings, numbers of PRNs in service, warning messages, and any other relevant information.

General service procedures

Repair of the Northstar M3 is performed at the factory. Factory service includes a complete checkout and recalibration. Shipping charges are the only costs for factory repair of a unit still under warranty.

FliteCard updates

FliteCard updates are made available on a 28-day update cycle. Install updates by removing the unit from the instrument panel (use a J-inch flat-blade screwdriver to loosen the retaining rod through the hole in the front panel). In the Northstar M3, turning the retaining rod moves the unit the last half-inch when inserting or removing the unit. Turn the rod to seat or remove the unit—do not damage the threads by forcing the unit in or out. Complete instructions are given in Section Three of the *Northstar M3 GPS Approach Reference Manual*. Press the button on the right side of the M3 to eject the card. Fully insert the new card, and replace the unit in the panel.

NOTE:

If you return a unit to the factory for repair, and you want the latest update to be installed at the same time, you must include payment to cover the cost of the update (unless the unit is eligible for a free update). Purchase order numbers from authorized Northstar dealers also are accepted. Call Northstar for pricing.

Returning the unit for service

An RMA number is required for returning any units to the Northstar factory. Packages received without an RMA number will be returned. Contact your Northstar dealer or the factory to obtain an RMA number.

Securely pack the unit in the original Northstar shipping carton, and return it to the address shown on page 29. Include your name, complete shipping address, daytime telephone number, complete description of the problem, desired return date, and shipping method. If shipping method isn't specified, units normally will be returned in about one week by UPS ground transportation. If you require faster service, use air express and specify your requirements. In emergencies, we can usually meet any reasonable request.

New units won't be supplied to replace those that have failed. Dealers returning units for credit, instead of repair, will be assessed a 15% restocking charge.

APPENDIX A

DO-160C ENVIRONMENTAL QUALIFICATION FORM

Product nomenclature: M3 Navigator (Part No. 1200-02-01 or 1200-03-01)
Manufacturer: Northstar Avionics, 30 Sudbury Road, Acton, MA 01720
TSO Approval: The Northstar M3 is FAA-approved under TSO-C129, Class A1

Table 5: Environmental Qualification Form

CONDITIONS	SECTION/ PARAGRAPH	DESCRIPTION OF CONDUCTED TESTS
Temperature and altitude	4.0	Equipment tested to category F1 (-55°C to +70°C to 55,000' MSL)
Low temperature operating	4.5.1	Equipment tested to Table 4-1
Low temperature survival	4.5.1	Equipment tested to Table 4-1
High short-time operating	4.5.2	Equipment tested to Table 4-1
High temperature survival	4.5.2	Equipment tested to Table 4-1
High temperature operating	4.5.3	Equipment tested to Table 4-1
In-flight loss of cooling	4.5.4	Equipment tested to Table 4-1
Altitude	4.6.1	Equipment tested to Table 4-1
Decompression	4.6.2	Not required for equipment
Overpressure	4.6.3	Not required for equipment
Temperature variation	5.0	Equipment tested to Category C
Humidity	6.0	Equipment tested to Category A
Operational shock	7.0	Equipment tested IAW Para. 7.2.1
Crash safety	7.0	Equipment tested IAW Para. 7.3.1
Vibration	8.0	Equipment tested to N, B, M
Explosion	9.0	Equipment identified as 'X'
Waterproofness	10.0	Equipment identified as 'X'
Fluids susceptibility	11.0	Equipment identified as 'X'
Sand and dust	12.0	Equipment identified as 'X'

Table 5: Environmental Qualification Form (Continued)

CONDITIONS	SECTION/ PARAGRAPH	DESCRIPTION OF CONDUCTED TESTS
Fungus	13.0	Equipment identified as 'X'
Salt spray	14.0	Equipment identified as 'X'
Magnetic effect	15.0	Equipment tested to Category Z
Power input	16.0	Equipment tested to Category B
Voltage spike conducted	17.0	Equipment tested to Category A
Audio frequency conducted	18.0	Equipment tested to Category B
Induced signal susceptibility	19.0	Equipment tested to Category Z
Radio frequency susceptibility	20.0	Equipment tested to Category U
Radio frequency emission	21.0	Equipment tested to Category B
Lightning-induced transient susceptibility	22	Equipment identified as 'X'
Lightning direct effects	23	Equipment identified as 'X'
Icing	23	Equipment identified as 'X'

Remarks:

1. Tests described in Sections 4, 5, 6, 7, and 8 were conducted by Associated Testing Laboratories, Wayne, New Jersey. Test Reports No. T31438-001 and T21794-11 are on file at Northstar Avionics.

2. Tests described in Sections 15, 16, 17, 18, 19, 20, and 21 were conducted by Chomerics, Radiation Test Services. The reports are on file at Northstar Avionics.

APPENDIX B

STC CERTIFICATE SA00464NY

United States Of America
Department of Transportation - Federal Aviation Administration

Supplemental Type Certificate

Number SA00464NY

This Certificate issued to Northstar Technologies
30 Sudbury Road
Acton, MA 01720

certifies that the change in the type design for the following product with the limitations and conditions therefor as specified hereon meets the airworthiness requirements of Part 3/23 *of the* Civil Air/Federal Aviation *Regulations.*

Original Product Type Certificate Number : 3A21

Make : CESSNA

Model : 210 Series

Description of Type Design Change: Installation of Northstar Avionics Global Positioning System Model M3 GPS Navigator, Part Number 1200-02-[ ] or 1200-03-[ ] for VFR and IFR Enroute, Terminal Area and Non-Precision Approach in accordance with Northstar Technologies Installation Manual P/N GM611, Rev. B dated July 1, 1996, or later FAA-approved revision.

Limitations and Conditions:
1. Northstar Technologies, Aircraft Flight Manual Supplement for the Cessna Aircraft Company Model 210 (series), Document No. 19960614, FAA approved August 19, 1996, or later FAA-approved revision, is required with this modification. Software revision 02.06, or later FAA-approved revision, must be installed within the Northstar Avionics M3 GPS Navigator for operational use as denoted within approval.

(See continuation sheet 2 of 2)

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application : February 01, 1996

Date of issuance : July 29, 1996

Date reissued :

Date amended : August 19, 1996, April 18, 1997

By direction of the Administrator

(*Signature*)

Ronald L. Vavruska
Manager
Boston Aircraft Certification Office

(*Title*)

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both.

FAA Form 8110-2(10-68) Page 1 of 2 *This certificate may be transferred in accordance with FAR 21.47.*

United States Of America

Department of Transportation - Federal Aviation Administration

Supplemental Type Certificate

(Continuation Sheet)

Number SA00464NY

Date of Issuance: July 29, 1996
Date Amended: April 18, 1997

Limitations and Conditions (Continued):

2. This approval should not be incorporated in any aircraft of this specific model on which other previously approved modifications are incorporated, unless it is determined that the inter-relationship between this change and any of those previously incorporated approved modifications will not introduce any adverse effect upon the airworthiness of the aircraft.

3. The STC holder will provide each person it permits to use this certificate to alter the product written evidence of the agreement in a form acceptable to the Administrator.

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both.

FAA Form 8110-2-1(10-69) Page 2 of 2 *This certificate may be transferred in accordance with FAR 21.47.*

APPENDIX C

APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT (AFMS)

Northstar Technologies
30 Sudbury Road
Acton, MA 01720

FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

for

CESSNA AIRCRAFT COMPANY

MODEL C210 (series)

with

Northstar M3 GPS Navigator

Reg. No. _____

Serial No. _____

This Supplement must be attached to the FAA Approved Airplane Flight Manual for a Cessna Aircraft Company Model C210 (series) when a Northstar M3 Navigator has been installed in accordance with Supplemental Type Certificate No. SA00464NY.

The information contained herein supplements or supersedes the basic Airplane Flight Manual only in those areas listed. For Limitations, Emergency Procedures, Normal Procedures and Performance information, consult the Airplane Flight Manual.

FAA APPROVED: _____

Ronald L. Vavruska, Manager
Boston Aircraft Certification Office
Federal Aviation Administration
Building 16
12 New England Executive Park
Burlington, MA 01803

Page 1 of 12 Document No. 19960614

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FAA Approved AUG 19 1996

LOG OF REVISIONS

A vertical bar on the outer margin of the
revised text page indicates a revision has been made to the text

Revision Number	Pages No.	Date	Remarks	FAA Approved
-	1-12		Original Supplement	
1	1	4/18/97	STC Amendment	

AUG 19 1996
FAA Approved _____

Document No. 19960614

Introduction

Equipment Description

The Northstar Technologies M3 GPS Navigator is designed under Technical Standard Order (TSO) C129, Class A1, and is installed to provide navigation guidance during en route, terminal and certain non-precision approach operations. The Northstar M3 Navigator system consists of a panel-mounted Global Positioning System (GPS) sensor/navigator and a GPS Pre-amplifier antenna. The M3 Navigator can control communications frequencies with the optional Northstar C1 Communications Transceiver installed as part of the system. The Northstar M3 obtains its navigation capability from use of the Department of Defense (DoD) satellite system.

The standard North America navigation database for the Northstar M3 GPS Navigator contains all private and public airports, navaids, and Victor and Jet airways within North America, with all waypoint coordinates referenced to the WGS-84 datum. The North America/APPROACH database adds non-precision approach waypoints and sequences which have been approved under the GPS overlay approach program as well as GPS standalone approaches. Optional International and Heliport databases are also available for the Northstar M3 GPS Navigator.

The Northstar M3 GPS Navigator is intended to be used as a supplemental navigation system, and is not currently approved as a source of sole-means navigation.

Provided the Northstar M3 GPS Navigator is receiving adequate usable signals it has been demonstrated capable of and has been shown to meet the accuracy specifications of:

> VFR and IFR en route oceanic and remote, en route domestic, and terminal operations within the U.S. National Airspace System and latitudes bounded by 10 degrees North and 78 degrees North using the WGS-84 (or NAD 83) coordinate reference datum in accordance with the criteria of AC 20-138, AC 91-49, and AC 120-33. Instrument approach (GPS, Loran-C, VOR, VOR/DME, TACAN, NDB, NDB/DME, and RNAV) operations are approved only within the conterminous United States. Navigation data is based upon use of only the GPS operated by the United States.

Northstar Technologies
Acton, MA 01720

Airplane Flight Manual Supplement
Northstar M3 GPS Navigator

SECTION 1: Limitations

A. When the Northstar M3 GPS Navigator contains software program version **02.06** or later version, the "Northstar M3 Navigator Reference Manual", P/N GM601, Rev. 02.00 or later must be immediately available to the flight crew whenever navigation is predicated on the use of the system.

B. IFR Navigation is restricted as follows:

1. The system must utilize software version V02.06 or later FAA-approved revision.

2. IFR en route and terminal navigation is prohibited unless the pilot verifies the currency of the database or verifies each selected waypoint for accuracy by reference to current approved data.

3. Instrument approaches must be accomplished in accordance with approved instrument approach procedures that are retrieved from the Northstar M3 GPS Navigator database. The M3 database must incorporate the current update cycle. If the database is not current, the pilot must acknowledge an advisory message on power-up. In addition, the NAV flag will be in view if an instrument approach procedure is executed with an expired database.

   (a) Instrument approaches must be conducted in the approach mode and RAIM must be available at the Final Approach Fix.

   (b) Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, and MLS approaches is not authorized.

   (c) When an alternate airport is required by the applicable operating rules, it must be served by an approach based on other than GPS or Loran-C navigation, the aircraft must have operational equipment capable of using that navigation aid, and the required navigation aid must be operational.

   (d) The reference coordinate datum system used for all approaches must be WGS-84 or NAD 83, which is also used internally within the Northstar M3 GPS Navigator.

   (e) Standard Instrument Departure procedures (SIDs) are not included in the Northstar M3 GPS Navigator database,

FAA Approved AUG 19 1996

Document No. 19960614

however all named waypoints used in SIDs are stored in the various waypoint categories (i.e. APT, VOR, INT, NDB) individually. A flight plan containing a SID sequence must be entered prior to departure if a SID is to be executed.

(f) Standard Terminal Arrival Routes (STARs) are not included in the Northstar M3 GPS Navigator database, and the Northstar M3 GPS Navigator is not approved for conducting STARs.

4. The aircraft must have other approved navigation equipment installed and operational appropriate to the route of flight.

SECTION 2: Emergency/Abnormal Procedures

Emergency Procedures

No change.

Abnormal Procedures

A. If the Northstar M3 GPS Navigator information is not available or invalid, utilize remaining operational navigation equipment as required.

B. If a "POOR GEOMETRY FOR GPS RAIM CHK" message is displayed, it means that RAIM is unavailable. If this appears while conducting an instrument approach, terminate the approach and execute a missed approach if required. If this message appears during the en route or terminal phase of flight, continue to navigate using the Northstar M3 GPS Navigator or revert to an alternate means of navigation appropriate to the route and phase of flight. When continuing to use GPS navigation, position must be verified every 15 minutes using another IFR-approved navigation system.

C. Refer to the M3 Reference Manual, Appendix B, for appropriate pilot actions to be accomplished in response to annunciated messages.

SECTION 3: Normal Procedures

WARNING

Familiarity with the en route operation of the M3 does not constitute proficiency in approach operations. Do not attempt approach operations in IMC prior to attaining proficiency in the use of the M3.

A. OPERATION

Normal operating procedures are outlined in the Northstar M3 GPS Navigator Reference Manual, P/N GM601, Rev. 02.00 or later.

B. APPROACH SEQUENCING

While enroute to the destination, designate the airport to be used for the approach via the **APCH** position. If necessary, use the large right knob to get to the display of the destination airport and RAIM prediction. Designate the desired airport and check for predicted RAIM availability.

Select the desired procedure on the left side display, and the associated procedure entry on the right. After selecting the desired procedure and entry type, press **-D>** followed by **ACK** to begin the approach sequence. Procedure entry choices are:

VECTORS TO FINAL: The FAF is made the current waypoint, bypassing any IAFs, transition fixes, or course reversals. The CDI displays cross-track error from the final approach course. To center the CDI and receive guidance direct to the FAF, instead of intercepting the final approach course, press **-D>** followed by **ACK**.

IAF: The displayed waypoint is an initial approach fix. Selection of an IAF implies that a full procedure is desired, including a procedure turn or a holding pattern in lieu of a procedure turn. In the case of a single waypoint which is both an IAF and an FAF, do not select entry via the IAF if the intent is to proceed straight in without a course reversal. In that case, use VECTORS TO FINAL.

TF: The displayed waypoint is a transition fix, with a published transition either to an IAF or to an FAF via a NoPT leg. If the approach plate shows a NoPT segment from a transition fix, the M3 will correctly omit the course reversal. It can be manually enabled, if desired, from **APCH** Level 3.

Note: Some approaches depict a "NoPT Arrival Sector Via Airway". These arrival sectors are not recognized by the M3. The M3 will NOT omit a course reversal unless the leg between two waypoints is specifically designated "NoPT" on the approach plate. Refer to the M3 GPS Navigator Reference Manual for instructions on how to manually enable or disable a procedure turn or holding pattern.

GENERAL NOTES

- The AirAlert™ special use airspace warnings are automatically disabled upon activation of an approach. AirAlert™ messages are re-enabled by selecting any other waypoint or route for current navigation except another approach sequence.

- Distances displayed on the M3 are always distance to the current waypoint. Some approach plates define stepdown fixes or even missed approach points as DME distance from an off-airport navaid. In this case, DME distance will be increasing as the aircraft proceeds inbound, while GPS distance to the next waypoint will be decreasing. Be careful to use the correct type of distance figure!

- GPS overlay and standalone approaches will always have a Final Approach Fix (FAF). In the case of an on-airport navaid, where the underlying approach has no FAF, a so-called "sensor FAF" will be created for the GPS sequence, usually 4 nm from the missed approach point (MAP). This waypoint will have the identifier "FFxx", where "xx" is extracted from the final approach course, such as "FF21" for a final approach course of 210 degrees. When flying a full approach, be sure to fly the procedure turn outbound **at least as far out as the FAF**, to be certain that the FAF will be in front of you on the procedure turn inbound. If the turn is completed inside of the FAF, the M3 will not sequence properly to the MAP and will remain with the FAF as the current waypoint.

- Some approach waypoints do not appear on the approach plates, especially in the case of NOS plates. Switching to **APCH** Level 3 and scrolling through the sequence in advance to verify the waypoints is highly recommended.

- DME arcs require no special action or technique. When an arc is part of the selected sequence, the M3 calculates a curved path rather than a straight one, and the pilot uses standard techniques to keep the CDI centered.

C. EXTERNAL ANNUNCIATORS

The Northstar M3 GPS Navigator drives four panel-mounted annunciators. The annunciators and their functions are:

MSG (Message): Operates in conjunction with the **MSG** button located on the Northstar M3 GPS Navigator. When flashing, informs the pilot that a new message is waiting to be displayed. Pushing the **MSG** button on the M3 will display the message, and pushing **MSG** a second time will dismiss the message. **MSG** remains illuminated while the message is still valid, and will only flash again if a new message becomes current.

WPT (Waypoint): Shortly before reaching the current active waypoint, the M3 will provide guidance along a curved path which will provide a smooth transition to the next leg. This feature is known as "turn anticipation." The WPT light begins flashing approximately ten seconds prior to arrival at the point at which a standard-rate turn to the next leg should be started. WPT illuminates solidly upon arrival at this turn point, and remains lit for approximately five seconds.

NOTE: The Final Approach Fix (FAF) and certain other designated approach waypoints must be overflown exactly and do not provide for turn anticipation. In these cases, the WPT light begins flashing approximately ten seconds prior to arrival at the actual waypoint, not at the turn point to the next leg.

PTK (Parallel Track): Remains illuminated whenever the pilot has manually selected the a parallel offset other than zero. Serves as a reminder that a centered CDI or D-bar will not represent an "on-course" condition. The parallel offset feature is disabled if approach mode has been selected.

APCH (Approach): The APCH light serves two related functions:

At a distance of 3 nm from the final approach fix (FAF), the APCH light will start to flash. This indicates an ***impending*** change to the CDI sensitivity. The CDI sensitivity will remain at 1 nm full-scale during this time.

At a distance of 2 nm from the FAF, the APCH light will illuminate solidly. This indicates that CDI sensitivity is automatically scaling from 1 nm full-scale to 0.3 nm full-scale at the FAF, that the aircraft is inbound with respect to the final

approach course, and that the RAIM alarm limit is set to the approach limit (0.3 nm).

If the **APCH** light does not illuminate solidly at two nautical miles from the FAF, the approach should be aborted.

D. NAV SOURCE SWITCHING

The Northstar M3 GPS Navigator is interfaced with a switching network to provide selection of display of Left/Right deviation, To/From flag, and NAV flag to the Bendix/King KI-525 Horizontal Situation Indicator (HSI). This switching network is controlled by the **NAV/GPS** selector switch. With **NAV** selected, both the HSI and autopilot are interfaced to the KX-155 Nav/Com system. With **GPS** selected, the HSI and autopilot are interfaced to the M3 GPS. Note that with **GPS** selected, the omni-bearing course selector (OBS) on the HSI is only used to provide a course datum to the autopilot. The M3 GPS does not "read" the OBS setting, and the OBS cannot be used to specify a desired course to the M3 GPS.

The NAV/GPS switching network incorporates a function which will inhibit deviation displays from the Northstar M3 GPS Navigator (and autopilot coupling) when the KX-155 is selected to an ILS or localizer frequency. In this case, the **NAV/GPS** switch will remain in the **NAV** state, regardless of the pilot's selection of **NAV** or **GPS**, until the KX-155 is tuned to a non-localizer frequency.

E. PILOT'S DISPLAY

Left/right steering information is presented on the HSI as a function of the NAV/GPS selector switch position. Additional navigation information, such as bearing and distance to waypoint, groundspeed, ground track, ETE, and track angle error is presented on the Northstar M3 GPS Navigator display.

F. AUTOPILOT COUPLED OPERATION

The Northstar M3 GPS Navigator may be coupled to the autopilot by first selecting **GPS** on the NAV/GPS switch. Manual selection of the desired track on the HSI OBS is required to provide course datum to the autopilot. The "DESIRED TRK" position under TRK - INFO on the M3 will always display the current desired track to be entered on the HSI. Frequent manual OBS knob changes may be necessary when the autopilot is coupled, such as in the case of flying a DME arc. The autopilot approach mode should be used when conducting a coupled GPS approach.

Northstar Technologies
Acton, MA 01720

Airplane Flight Manual Supplement
Northstar M3 GPS Navigator

SECTION 4: Performance

No change.

FAA Approved AUG 19 1996

Document No. 19960614

APPENDIX D
SPECIMEN FORM 337

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. Description of Work Accomplished

(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)

A. The following equipment and major components were removed:
1. (none)

B. The following equipment and major components were installed:
1. 1 ea. Northstar Avionics M3 Navigator, P/N 1200-02-01, TSO-C129 Class A1
2. 1 ea. Northern Airborne Technology RS08-001 Remote Switch (if installed)
3. 1 ea. Comant Industries, Inc. Active GPS Antenna, P/N CI 405-7 (if installed)

C. All equipment was previously approved under Supplemental Type Certificate Number SA00464NY.

D. Deviations from STC Number SA00464NY include the following:

(Note: List all equipment and major components removed, if any, and list all equipment and major components installed which may require reference to manufacturer's instructions. In addition, if a "localizer override" function is **NOT** provided as part of a NAV/GPS switching system (if installed), this must be listed as an STC deviation.)

E. The installation was made with reference to Northstar Avionics M3 GPS APPROACH Navigator, Installation Manual, P/N GM611, Rev. B, July 1, 1996 (or later, as appropriate).

F. **(For VFR Installations:)**
The Northstar M3 Navigator is limited to VFR Navigation and was installed and tested in accordance with AC 20-138, Paragraph 7.c.(2).

(For IFR Installations:)
The Northstar M3 Navigator is approved for VFR and IFR En Route, Terminal Area, and Non-Precision Approach Navigation, and was installed and tested in accordance with AC 20-138, Paragraph 8.c.(2).

[X] Additional Sheets Are Attached

G. An Airplane (or Rotorcraft) Flight Manual Supplement, Document No. (or Report or Part No.) (or Supplemental Flight Manual) is approved by the FAA Form 337, dated _____, and has been installed within the Airplane (or Rotorcraft) Flight Manual. (Refer to AC 20-138, Appendix 2.)

H. All inspection records and other documents pertaining to this major alteration are on file at (Your Avionics Company) under Work Order _____ .

I. The alteration was performed in accordance with AC 43.13-1A, Chapter 11, Paragraphs 424, 425, 427, and 429 through 452, 464 through 466, 478 through 481, 514 through 519, and Chapter 15, Paragraphs 748 through 753, 820 through 822, 826, 827, and 842, and Chapter 16, Paragraphs 880 through 882 and 913; and AC 43.13-2A, Chapter 1, Paragraphs 1 through 12, Chapter 2, Paragraphs 21 through 23, and Chapter 3, Figure 3.6 and Paragraph 39.
(Note: List appropriate subject Chapters and Paragraphs which apply to your alteration.)

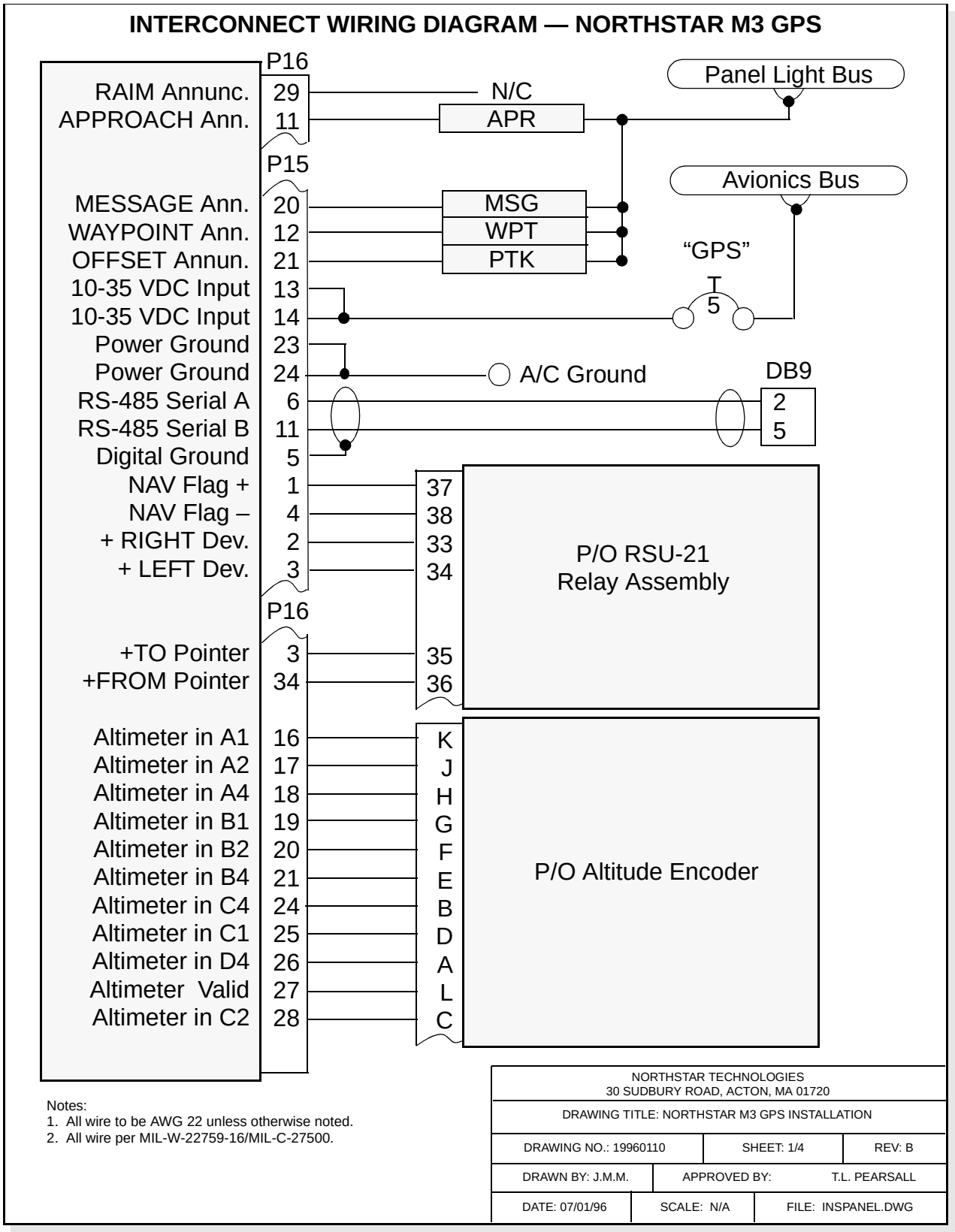
J. The aircraft weight and balance, and the equipment list were amended in accordance with AC 43.13-1A, Chapter 13, Paragraphs 659 through 663.

K. An electrical load analysis was performed in accordance with AC 43.13-1A, Chapter 11, Paragraph 428, and determined that the total load does not exceed 80% of the total rated alternator capacity.

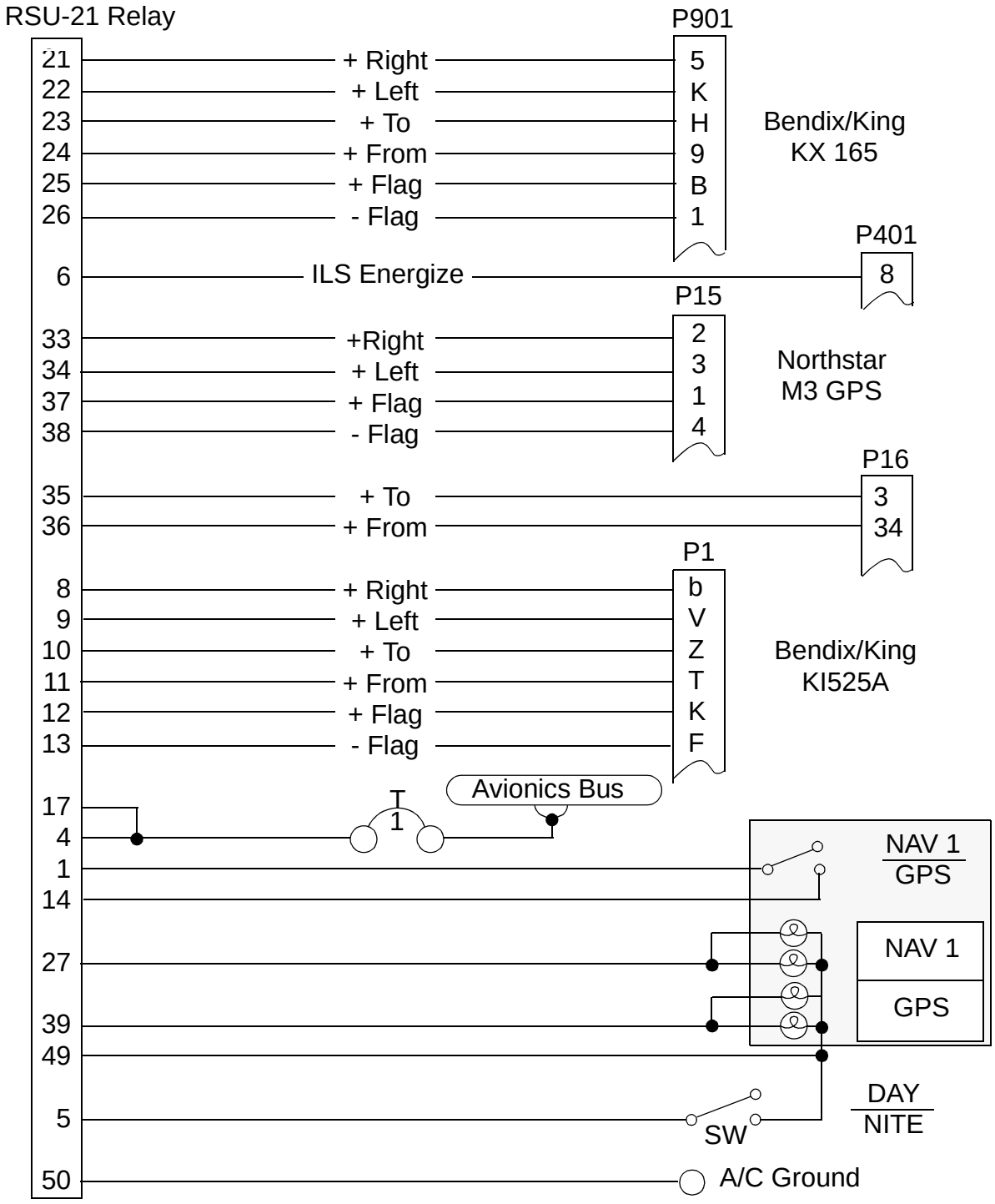
END

APPENDIX E

STC Installation Documentation



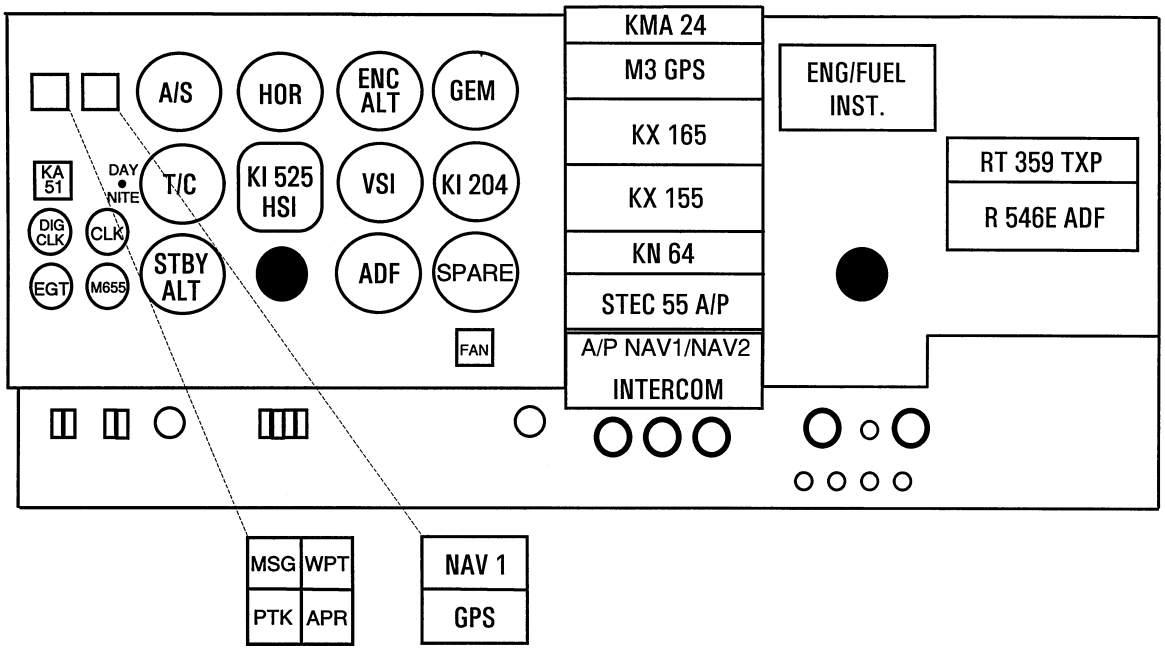
INTERCONNECT WIRING DIAGRAM — RSU-21/NAV-GPS SOURCE/HSI SWITCHING



Notes:
1. All wire to be AWG 22 unless otherwise noted.
2. All wire per MIL-W-22759-16/MIL-C-27500.

NORTHSTAR TECHNOLOGIES 30 SUDBURY ROAD, ACTON, MA 01720		
DRAWING TITLE: NORTHSTAR M3 GPS INSTALLATION		
DRAWING NO.: 19960110	SHEET: 2/4	REV: B
DRAWN BY: J.M.M.	APPROVED BY: T.L. PEARSALL	
DATE: 07/01/96	SCALE: N/A	FILE: INSPANEL.DWG

PANEL DRAWING FOR NORTHSTAR M3 GPS SYSTEM AS INSTALLED WITHIN CESSNA 210



NOTES:

1. Equipment and components installed in accordance with Section 2.4, “M3 Navigator Installation,” and FAA Advisory Circulars 43.13-1A, Chapter 11 and 43.13-2A, Chapters 1 and 2.

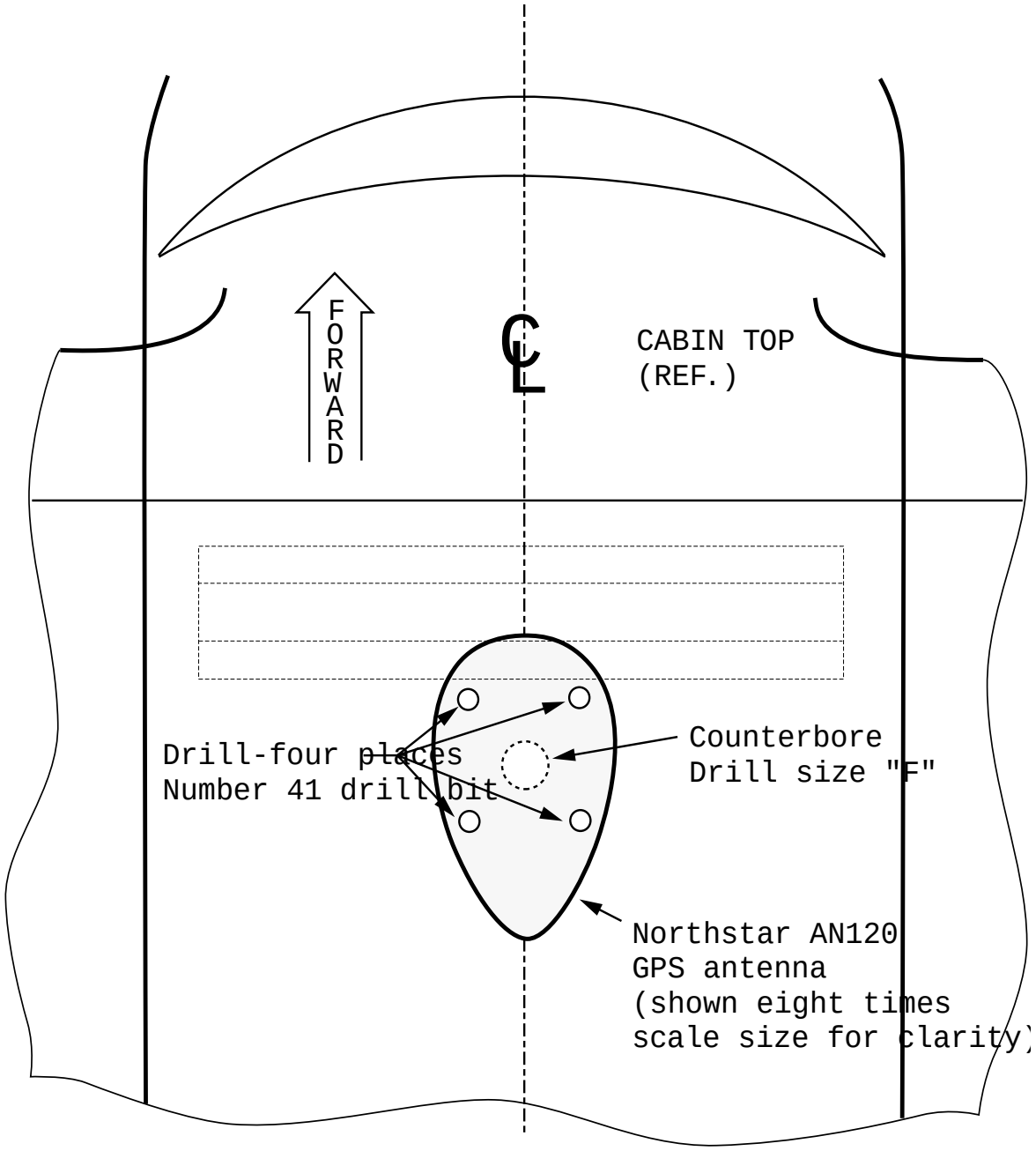
2. Adequate cooling must be provided by the avionics cooling fan.

3. The M3 circuit breaker is resettable trip-free type Klixon 7277-2-() labelled as specified and located within the main circuit-breaker panel.

4. Fabricate placards for circuit breakers and switches of white lettering on black background in 12-point Helvetica font, and affix adjacent to appropriate annunciator, switch, or circuit breaker as illustrated.

NORTHSTAR TECHNOLOGIES 30 SUDBURY ROAD, ACTON, MA 01720		
DRAWING TITLE: NORTHSTAR M3 GPS INSTALLATION		
DRAWING NO.: 19960110	SHEET: 3/4	REV: B
DRAWN BY: J.M.M.	APPROVED BY:	T.L. PEARSALL
DATE: 07/01/96	SCALE: N/A	FILE: INSPANEL.DWG

AN120 GPS ANTENNA INSTALLATION DRAWING FOR NORTHSTAR M3 GPS SYSTEM



NOTES:

1. Cabin-top hole location for Northstar AN120 GPS antenna connector 1.55 inches aft of front spar carry-thru and on centerline.
2. Install AN120 with four AN570 #6-32 machine screws and four AN442 #6-32 elastic stop washers.
3. Insert AN960 #6 flat washers between fuselage and AN442 nuts.
4. Torque AN442 nuts to 12 –15 inch-pounds.
5. Follow recommended methods, techniques, and practices found within FAA Advisory Circular 43.13-2A, Chapter 3.

NORTHSTAR TECHNOLOGIES 30 SUDBURY ROAD, ACTON, MA 01720		
DRAWING TITLE: NORTHSTAR M3 GPS INSTALLATION		
DRAWING NO.: 19960110	SHEET: 4/4	REV: B
DRAWN BY: J.M.M.	APPROVED BY:	T.L. PEARSALL
DATE: 07/01/96	SCALE: N/A	FILE: AIRFRAME.DWG